CLAIMS

1. A method of converting a non-gaseous sample for accelerator mass spectrometry analysis, comprising:

converting desired elements present in the non-gaseous sample to a predetermined gaseous form; and

transporting the predetermined gaseous form to an accelerator mass spectrometer ion source.

2. The method of claim 1, wherein said step of converting comprises chemically reacting the non-gaseous sample.

3. The method of claim 2, wherein said step of chemically reacting comprises oxidizing the non-gaseous sample.

4. The method of claim 3, wherein said step of oxidizing comprises converting carbon in the sample to carbon dioxide.

5. The method of claim 2, wherein said step of chemically reacting comprises pyrolyzing the non-gaseous sample.

6. The method of claim 5, wherein said step of pyrolyzing comprises converting hydrogen in the sample to molecular hydrogen.

7. The method of claim 1, wherein prior to said step of converting, said method comprises:

depositing the non-gaseous sample on a solid substrate, and

desorbing the non-gaseous sample from said substrate.

8. The method of claim 7, wherein said step of desorbing comprises irradiating the sample with a laser beam.

9. The method of claim 7, wherein volatile components are removed from the sample subsequent to said step of depositing and prior to said step of desorbing.

10. The method of claim 1, wherein prior to said step of converting, said method comprises nebulizing the sample.

11. The method of claim 10, wherein said step of nebulizing comprises thermospraying the sample.

12. The method of claim 10, wherein said step of nebulizing comprises electrospraying the sample.

13. The method of claim 10, wherein said step of nebulizing comprises substantially removing volatile components from the sample.

14. A method of converting a non-gaseous sample for analytical processing, said method comprising:

nebulizing the sample using electrospray;

converting desired elements present in the nebulized sample to a predetermined gaseous form; and

providing the predetermined gaseous form to an analytical processing device for analysis.

15. The method of claim 14, wherein the analytical processing device comprises an isotope ratio mass spectrometer.

16. The method of claim 14, wherein the analytical processing device comprises an accelerator mass spectrometer.

17. The method of claim 14, wherein said step of converting comprises directing at least a portion of the nebulized sample into a chemical reactor.

18. The method of claim 14, wherein prior to said step of nebulizing, said method comprises adding sub-micrometer sized particles to the non-gaseous sample.

19. The method of claim 18, wherein said sub-micrometer sized particles comprise silicon dioxide.

20. The method of claim 18, wherein said sub-micrometer sized particles comprise barium hexaaluminate.

21. A method of converting a non-gaseous sample for analytical processing, comprising:

injecting the sample directly into a converter;

converting desired elements present in the sample to a predetermined gaseous form; and

providing the predetermined gaseous form to an analytical device for processing.

22. The method of claim 21, wherein the analytical processing device comprises an

accelerator mass spectrometer.

23. The method of claim 21, wherein the analytical processing device comprises an isotope ratio mass spectrometer.

24. The method of claim 21, wherein said step of converting comprises converting the hydrogen in the sample to molecular hydrogen.

25. The method of claim 21, wherein said converter comprises a pyrolizer.

26. The method of claim 21, wherein said step of injecting comprises introducing the sample into the converter using a piezo-electric pipetter.

27. An interface for introducing a non-gaseous sample as a predetermined gaseous form into an accelerator mass spectrometer, said interface comprising:

a nebulizer that receives the non-gaseous sample to provide a fine spray of the sample;

a converter that receives at least a portion of said fine spray and converts the desired elements to the predetermined gaseous form; and

a flow line that transports the predetermined gaseous form to the accelerator mass spectrometer.

28. The interface of claim 27, wherein said nebulizer comprises an electrospray nebulizer.

29. The interface of claim 27, wherein said nebulizer comprises a thermospray nebulizer

30. The interface of claim 27, further comprising a chamber that couples said nebulizer to said converter, said chamber comprising means for reducing the flow of matter that does not contain analyte into said converter.

31. The interface of claim 30, wherein said chamber comprises a momentum separator.

32. The interface of claim 30 wherein said chamber comprises means for producing a beam of particles preferentially composed of analyte.

33. A sample processing interface for introducing a non-gaseous sample as a predetermined gaseous form into an analytical instrument, said interface comprising:

an electrospray nebulizer that receives the non-gaseous sample to provide a fine spray of the sample;

a converter that receives at least a portion of said fine spray and converts the desired elements in the spray to the predetermined gaseous form; and

a flow line that transports the predetermined gaseous form to the analytical instrument.

34. The interface of claim 33 wherein the analytical instrument comprises an accelerator mass spectrometer.

35. The interface of claim 33 wherein said converter comprises copper oxide.

36. A device for introducing a non-gaseous sample as a predetermined gaseous form into an analytical instrument, said device comprising:

an injector that receives the non-gaseous sample and provides a directed stream of the non-gaseous sample;

a converter that receives at least a portion of said directed stream and converts the desired elements to the predetermined gaseous form; and

a flow line that transports the predetermined gaseous form to the analytical instrument.

37. The device of claim 36, wherein said injector is configured and arranged to provide a drop diameter less than about 500 μm and a sufficiently high drop velocity to permit droplets to travel a distance greater than about 1 cm in air.

38. The device of claim 37 wherein said injector comprises a piezoelectric pipetter.

39. The device of claim 36 wherein said converter comprises elemental carbon.

40. An interface for introducing a non-gaseous sample as a predetermined gaseous form into an accelerator mass spectrometer, said interface comprising:

a first stage that receives the non-gaseous sample and separates analyte from carrier material of the sample, to provide a separated sample stream that preferentially comprises the analyte; and

a second stage that receives said separated sample stream, converts the desired elements in said sample stream to the predetermined gaseous form, and transports the predetermined gaseous form along a flow line to the accelerator mass spectrometer.

41. The interface of claim 40, wherein said first stage comprises a nebulizer.

42. The interface of claim 40, wherein said first stage comprises means for desorption.

43. The interface of claim 42 wherein said means for desorption comprises a laser.

44. The interface of claim 40 wherein said second stage comprises an oxidizing reactor.